Nick's Niche

Guest Column

Let's get loaded....

Nick Liberto, P.E. ***Powder Coating Consultants, div. of Ninan, Inc.***

Being a "child of the 60's," this title can have a whole different meaning from what I'm about to discuss here. This article is about loading and unloading a powder coating line to achieve maximum productivity.

No powder coating line, or finishing line for that matter, is an island unto itself. Finishing systems must be seamlessly integrated into the manufacturing process they serve. This means product must freely and efficiently flow from fabrication into finishing then to assembly.

Surprisingly enough, we frequently see finishing systems that have been designed and installed without proper consideration on how you can load, unload, hang, transport, or otherwise move product onto, off-of, and through the process. It totally amazes me that companies will spend vast amounts of money on the latest application gun, color-change system, robots, or computer controls and ignore how the process can be effectively loaded/unloaded. This practice dooms the process to be highly inefficient and costly.

How many touches?

The first thing you can do to determine efficient product handling is count the number of times a part is handled through the fabrication, finishing, and assembly processes. Isolate the results by shop area (that is, fabrication, finishing, and assembly). You may be surprised by the results of this simple exercise.

You may find that you're constantly removing parts from bins to perform an operation and then placing them back into different bins. Then these bins are moved from one operation to another, where they are "touched" over and over again. Then they're moved to the finishing line where they're at least "touched" two more times to load and unload the parts onto the conveyor line. This process is inefficient, especially when you consider the forklift traffic necessary to move the bins between the different stations/processes.

We won't discuss the possible simplification of the fabrication and assembly processes in this article. However, there is at least one simple improvement that can benefit the finishing process that can be discussed. Why not load the parts onto racks/hangers at the final stage of the fabrication process? This way the entire rack/hanger of parts can be loaded onto the finishing con-

Figure 1

Small parts loaded off-line.

Figure 2

Disorganized and congested loading of parts decreases overall finishing efficiency.

Figure 3

Parts on an overhead conveyer moving through a powder coating operation that's well-organized but congested

veyor without having to "touch" each individual part. Of course, you can then remove the entire rack/hanger of parts from the line at the end of the finishing process and transport them on carts to assembly. This can be an effective way to reduce part handling on small parts (Figure 1) but is impractical for reduced processing of large parts, where loading heavy racks/hangers onto/off-of the finishing conveyor can't be executed.

Conveyor design choices

The most effective way of improving part handling is by using different conveyor systems or layouts. Simply modifying existing conveyor layouts, or designing new conveyor layouts, to connect the fabrications, finishing, and assembly areas will eliminate several "touches" on the parts. This way your fabrication personnel load the parts directly onto the finishing conveyor, and the parts are automatically transported through the finishing operation and unloaded at the assembly area.

This approach can be done with all types of conveyance designs: unpowered push/pull conveyors, powered conveyors, and power-and-free conveyors. However, the most flexible of these designs is the power-and-free conveyor because it can be stopped during loading/unloading and conveyed at different transport and processing speeds. It can even be used to store parts at the fabrication or assembly areas by using bias banking to allow for timely release to the point of use. Having a conveyor that isn't moving during loading/unloading operations is a must when you are processing large and heavy parts.

Finishing systems must be seamlessly integrated into the manufacturing process they serve.

Realizing that power-and-free conveyors aren't in everyone's budget, simply extending existing power conveyors to the point of inception and use for production parts can be a more practical solution. This approach eliminates congested load/unload areas on finishing lines that are loaded with forklifts, bins, hangers, shop personnel, and so on while still eliminating "touches" on individual parts for coating purposes.

Rush-hour traffic

I'm amazed at the number of places I've visited where the finishing line load/unload area looks like Times Square on New Year's Eve. (See figures 2 and 3.) There are forklifts bringing products to the line or taking them from the line, bins of unfinished or coated parts, piles of hangers and hooks, and hordes of people busy loading/unloading racks of parts moving through this chaos on an overhead conveyor. This bedlam can be a recipe for disaster, and it's surprising that more accidents don't happen under these circumstances.

Some situations can be improved with simple organization of the area. Using conveyor loops to extend the load/unload areas allows more room for easier movement of people and materials. The use of lifts, hoists, and so on can ease the pain of loading large unwieldy parts. Storing unused racks/hangers on carts can be a simple way of controlling clutter.

Some of our clients use flat-belt conveyors to bring parts to/from the finishing line (Figure 4). This approach eliminates bins and forklift traffic but can only be practical if the fabrication and assembly areas are close by; otherwise, the belt conveyor can be expensive.

Hanger/rack design basics

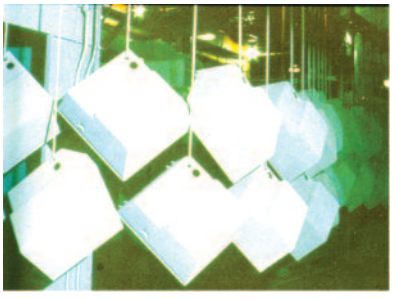
I've often said: "You can put a dozen people in a room to design a new hanger, and you'll have a dozen different hanger designs." All of these designs would work. The only difference is how well they would work. Hanger designs are often influenced by the experience of the designer. For instance, load/unload personnel would design hangers that are easy to load/unload the parts, while the booth operator would design the hanger for easy gun set-up and part coat-ability. Hangers must be de-

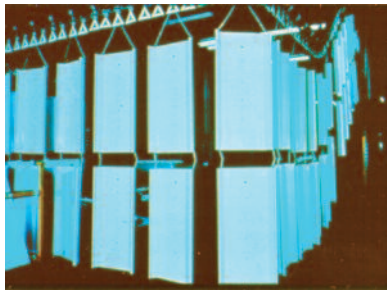
FIGURE 4

A flat-belt conveyor in the load area eases handling of heavy parts.

FIGURE 5

Examples of good part racking density





signed to accomplish both of these goals, and much more.

Successful hanger designs allow ease of loading/unloading the parts, proper presentation for coating, protection of contact points to ensure reliable part ground, and proper drainage for the parts in the washer. Simplicity in hanger management can be accommodated by designing hangers that work for multiple parts, as long as the basic principles of hanger design aren't unduly compromised.

Part density on the hanger should be a paramount concern to ensure excellent first pass transfer efficiency (Figure 5). However, this objective needs to be counterbalanced by ensuring that the operators can easily load/unload the parts, that the conveyor isn't loaded beyond its capacity, and that the parts don't shadow each other reducing electrostatic wrap. If you're dealing with lots of small parts that take more time than is available to load onto a moving conveyor, then consider pre-racking the hangers in off-line stations and loading full hangers onto the conveyor. Part spacing on the hanger and between hangers should be 1.5 times the depth of the part to ensure proper electrostatic wrap.

Two-point hangers (using two conveyor hang points) require some extra consideration to ensure that parts will successfully traverse the conveyor path through the system. One concern with two-point hanging schemes is "chording," where the leading hook is exiting the conveyor turn while the lagging hook isn't yet at the 90-degree location on the turn. This leads to the lagging hook being "pulled" by the part through the turn, bending the hook/part and possibly dislodging the part from the hanger entirely. This situation can be avoided by ensuring that the two hang points aren't separated by more distance than one quarter of the circumference of the smallest conveyor turn.

The opposite problem of chording is part "kick-out." This predicament is caused by having the two-point hangers too close together on a long part. In this case, the hangers easily traverse the turns, but the ends of the part kick-out past the turn and can impact other parts or equipment encumbrances (walls, support columns, people). Checking part clearance around all conveyor turns, moving the hang points closer to the ends of the part, or doing both these things eliminates this problem.

Protecting the part contact point is important to ensuring consistent part grounding. Designing hangers that always use the same point on the hook to hold the part will protect this area from being coated, no matter how many times the hangers go through the finishing process. Using square stock steel "on edge" to form the part hook points will also help in maintaining proper part ground. This can be accomplished by simply turning the square stock 45 degrees so that the edge of the square is the surface the part contacts.

Summary

The efficiency of most finishing systems starts at the load/unload area. Failure to properly design hangers/racks and load/unload areas, and to reduce part touches will doom a system to inefficiency. Congestion and chaos in this area can lead to more inefficiencies and possible accidents.

Using conveyor design options, well-thought-out hanger design, and simple organizational techniques will ensure that your finishing process provides well-coated products at a reasonable cost. **PC**

Editor's note

For further reading, see the "Index to Articles and Authors 1990-2008," Reference and Buyer's Resource Issue, *Powder Coating*, vol. 19, no. 9 (December 2008), or click on the Article Index at [www.pcoating.com]. Article can be bought online. Have a question? Click on Problem Solving to submit one.

Nick Liberto is president of Powder Coating Consultants (PCC), a division of Ninan, Inc., 1529 Laurel Ave., Bridgeport, CT 06604. Established in 1988, PCC is an independent engineering firm specializing in the use of powder coating technology. Nick has more than 2 decades of experience in the powder coating industry and is a member of many industry associations, including the Application Equipment Technical Committee of the Powder Coating Institute. A registered professional engineer in Connecticut, he holds a bachelor's of science degree in mechanical engineering with a minor in physics. A prolific writer and seminar presenter, Nick is a contributing author to two industry handbooks and more than 30 articles for various industry magazines, including Powder Coating *magazine. Nick has held various sales, marketing, and technical positions for Ransburg-Gema and Interrad, which are powder application and recovery equipment companies. He can be contacted at 203/366-7244; email [pcc@powdercoat.com]; Web site [www.powdercc.com].*